

Developing and enhancing Landsat derived Evapotranspiration and surface energy products



Rick Allen, University of Idaho

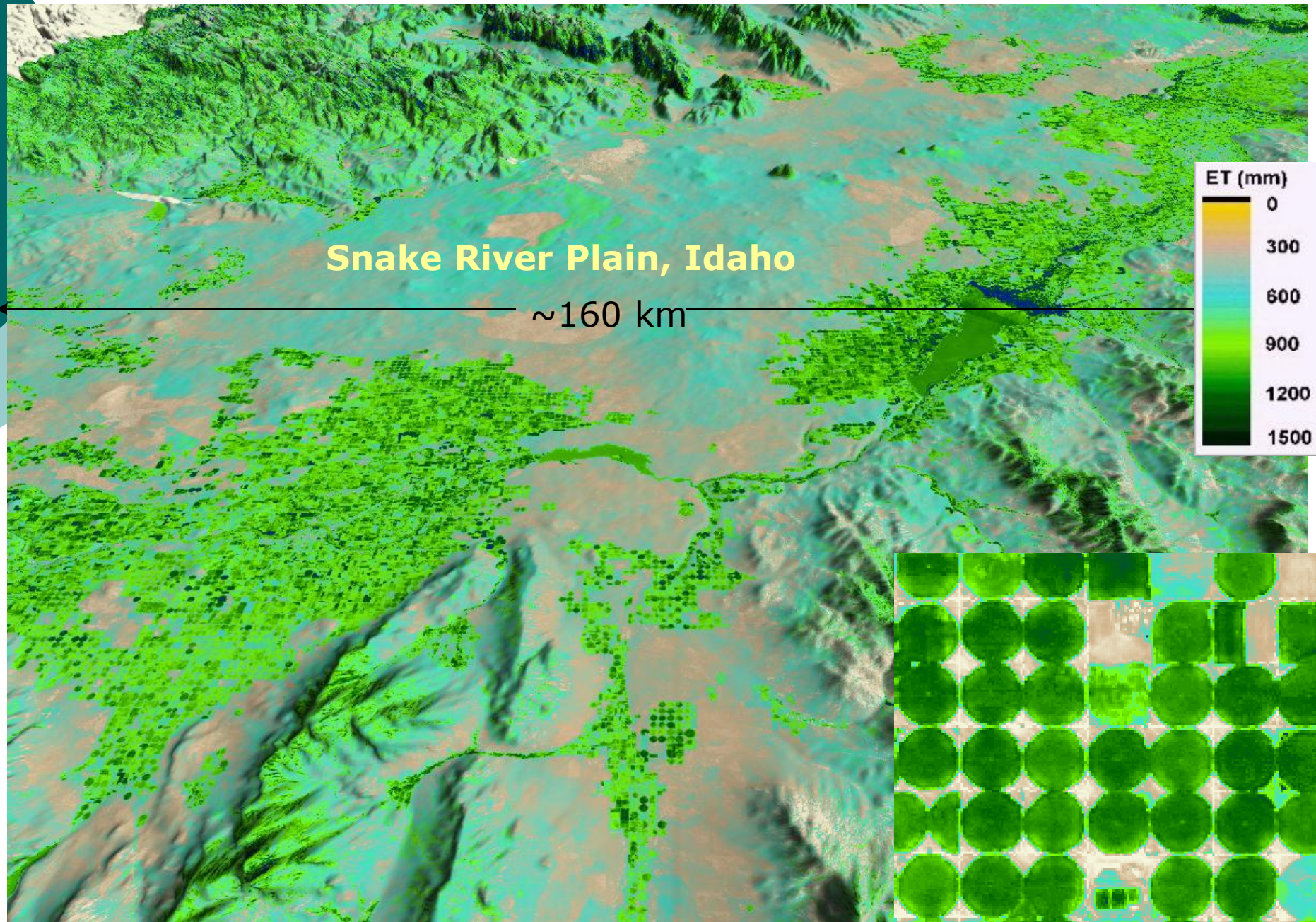
Ayse Kilic, University of Nebraska-Lincoln

Justin Huntington, Desert Research Institute

Tony Morse, Spatial Analysis Group

ET at 30 m resolution

*Growing Season ET -- April --
October, 2006 from METRIC-Landsat*



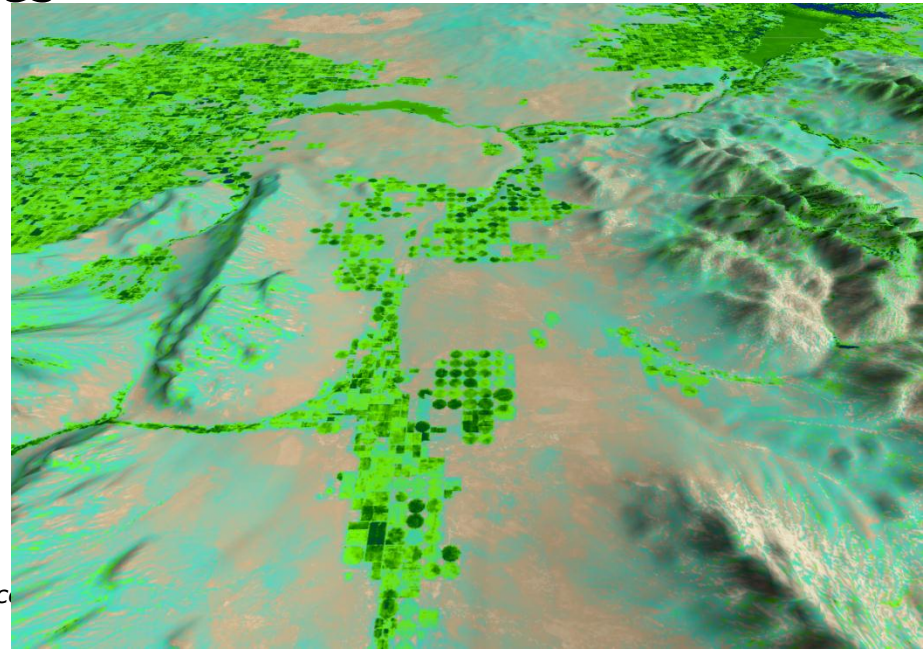
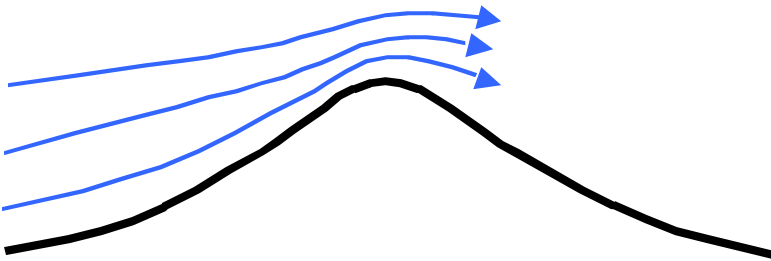


Primary goals

- Advance, produce and demonstrate operational production of **Evapotranspiration** based on Landsat TM, ETM+ and LDCM data
- Apply and leverage the thermal data of Landsat for expanded use in water and land resources management.
- Demonstrate the Importance of Thermal Imaging for future Landsat Missions

Specific focus areas – ET in Mountains

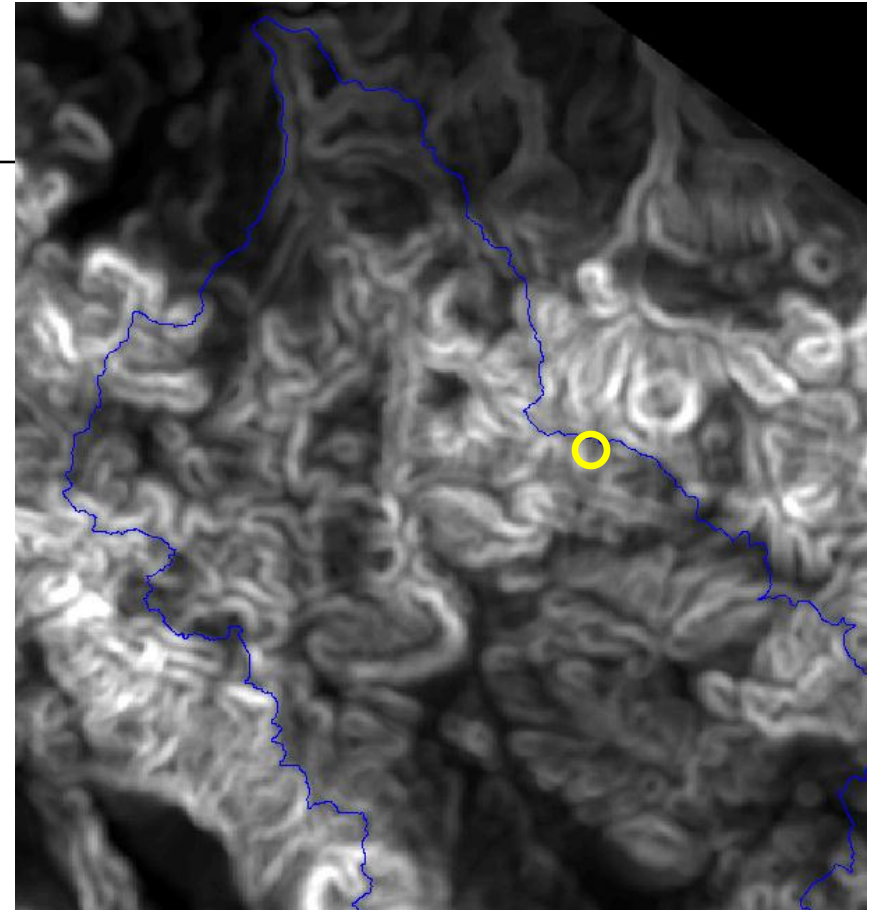
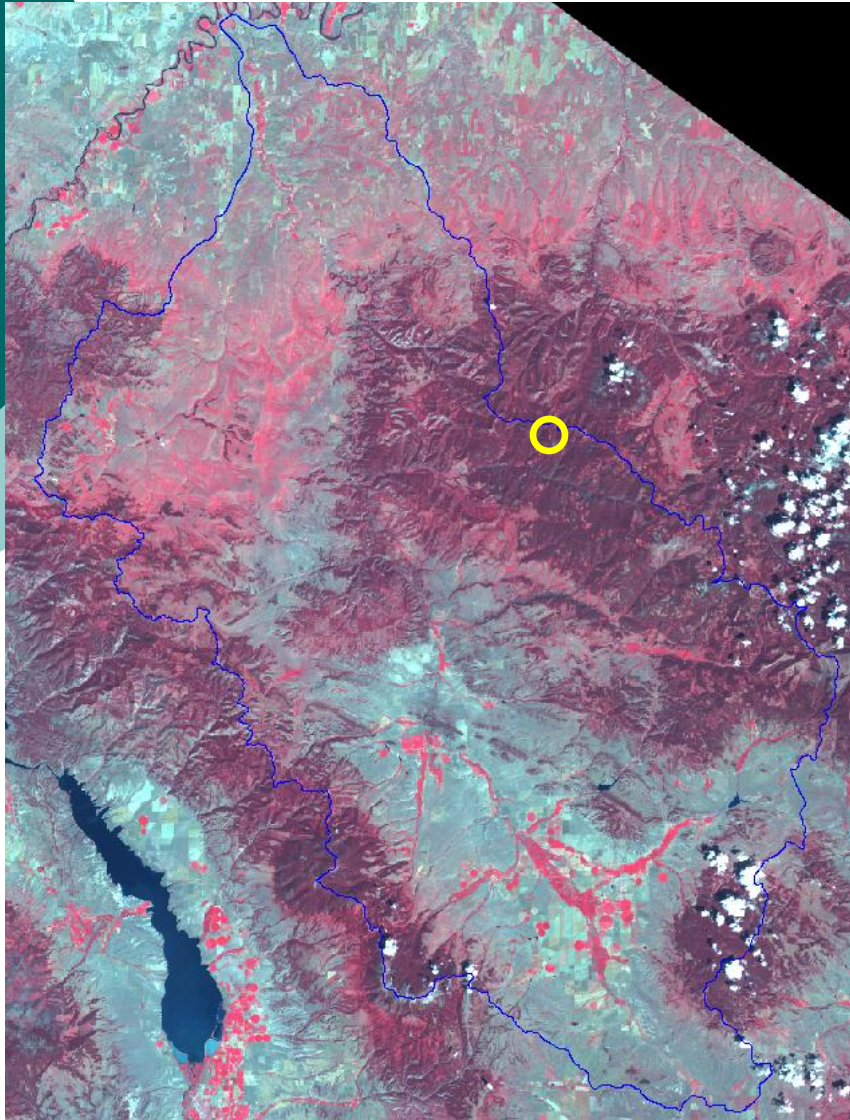
- Mountain aerodynamics
 - terrain roughness
 - wind speed vs. elevation
 - wind shielding by mountains
 - impact of wind direction
 - Short-wave and thermal radiation models on slopes



Increasing Aerodynamic Roughness for Terrain Roughness

07/18/2007 L5

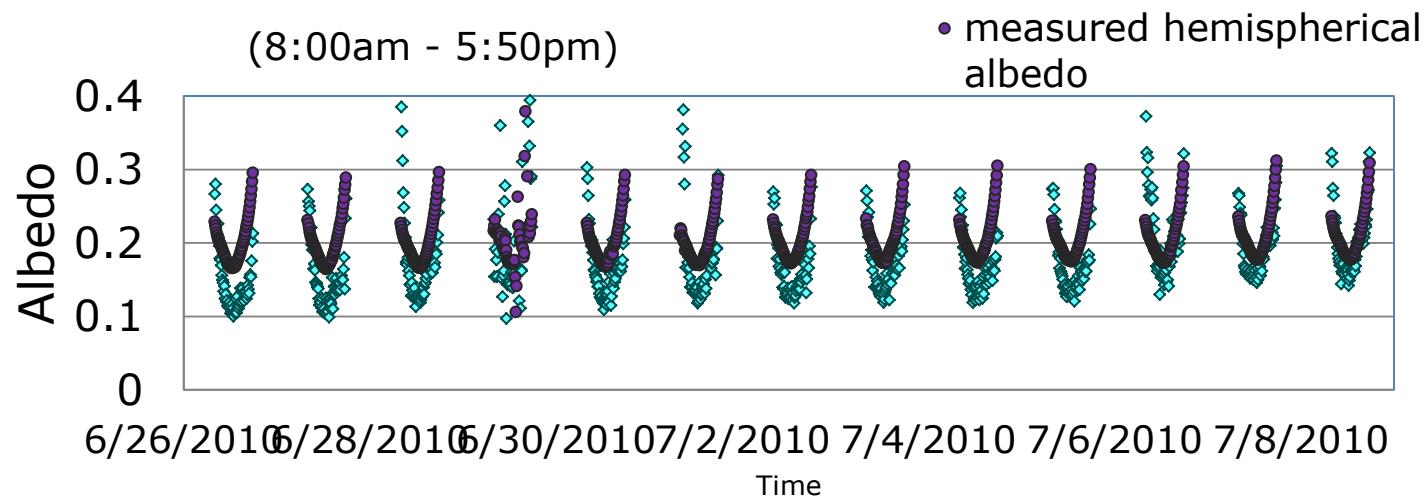
Std. Dev. of elevation, m



$$z_{om} = z_{om}^{\text{flat}} + f(\text{Std.Dev.DEM}, z_{om}^{\text{flat}})$$

Specific focus areas – Nadir View

- Adjustment of nadir reflectance to hemispherical



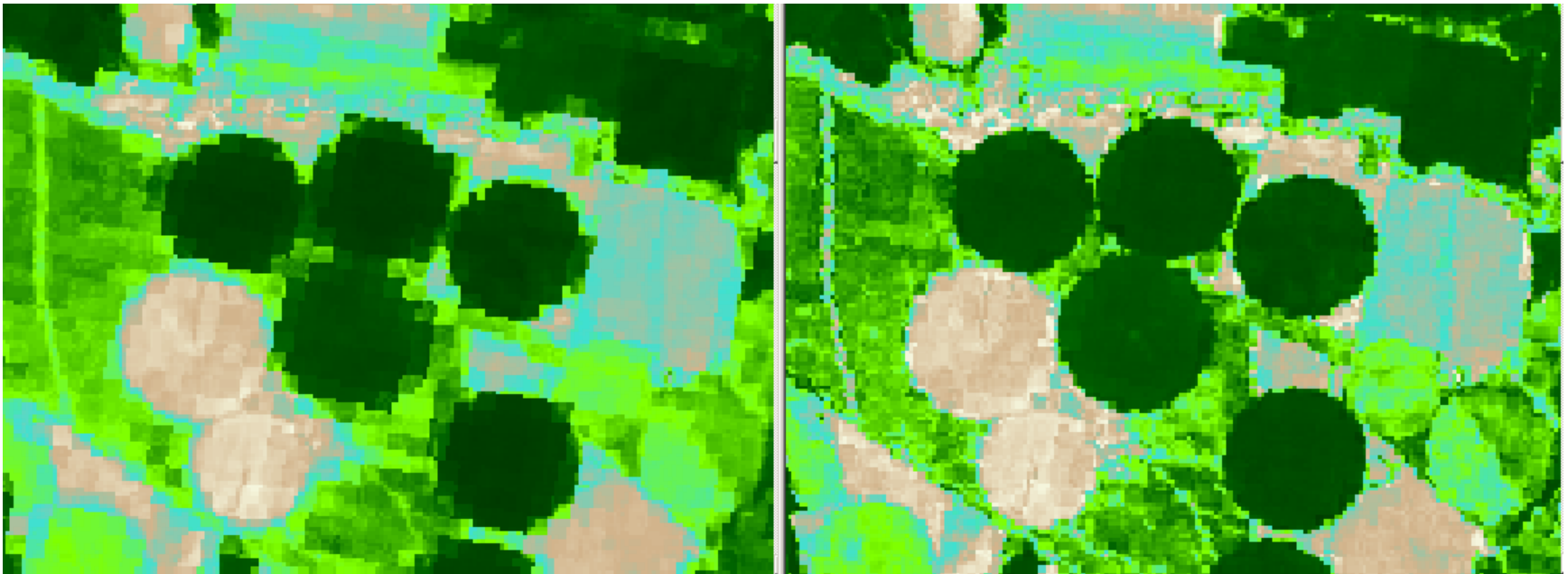
Specific focus areas – Water Bodies

- Aerodynamic estimation of evaporation from open water
- Time of Day strategies for time extrapolation of ET “snapshots”



Specific focus areas – Field Scale ET

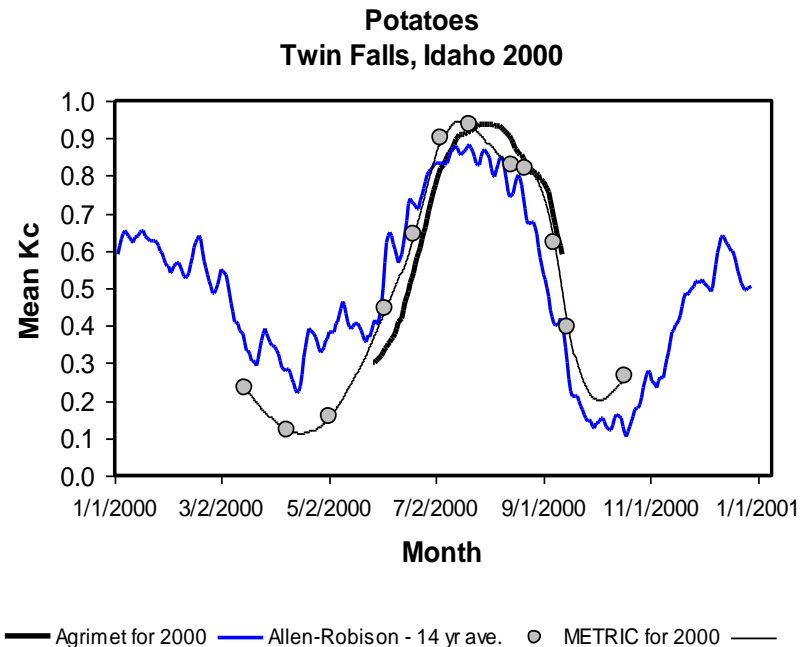
- Sharpening Landsat 120 m thermal to 30 m
- Sharpening MODIS 1000 m and VIIRS thermal to 30 m



How many Landsats?

We would 'like' one 'point' (image) each 32 days (minimum) to follow evolution of vegetation and water availability

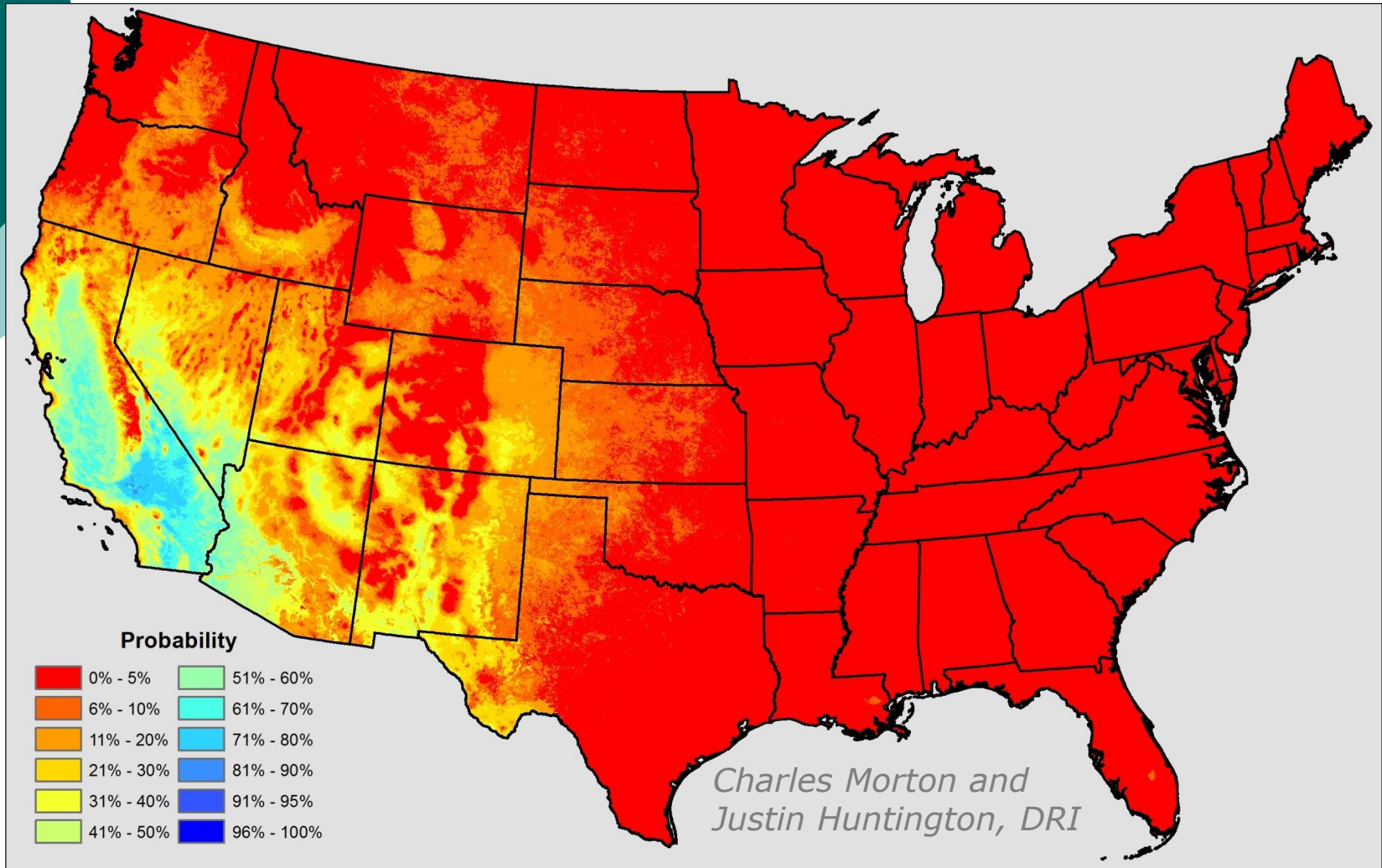
- *Cloud probabilities require a four day return time to insure the clear view each 32 days for most areas*



1 Satellite (each 16 days)

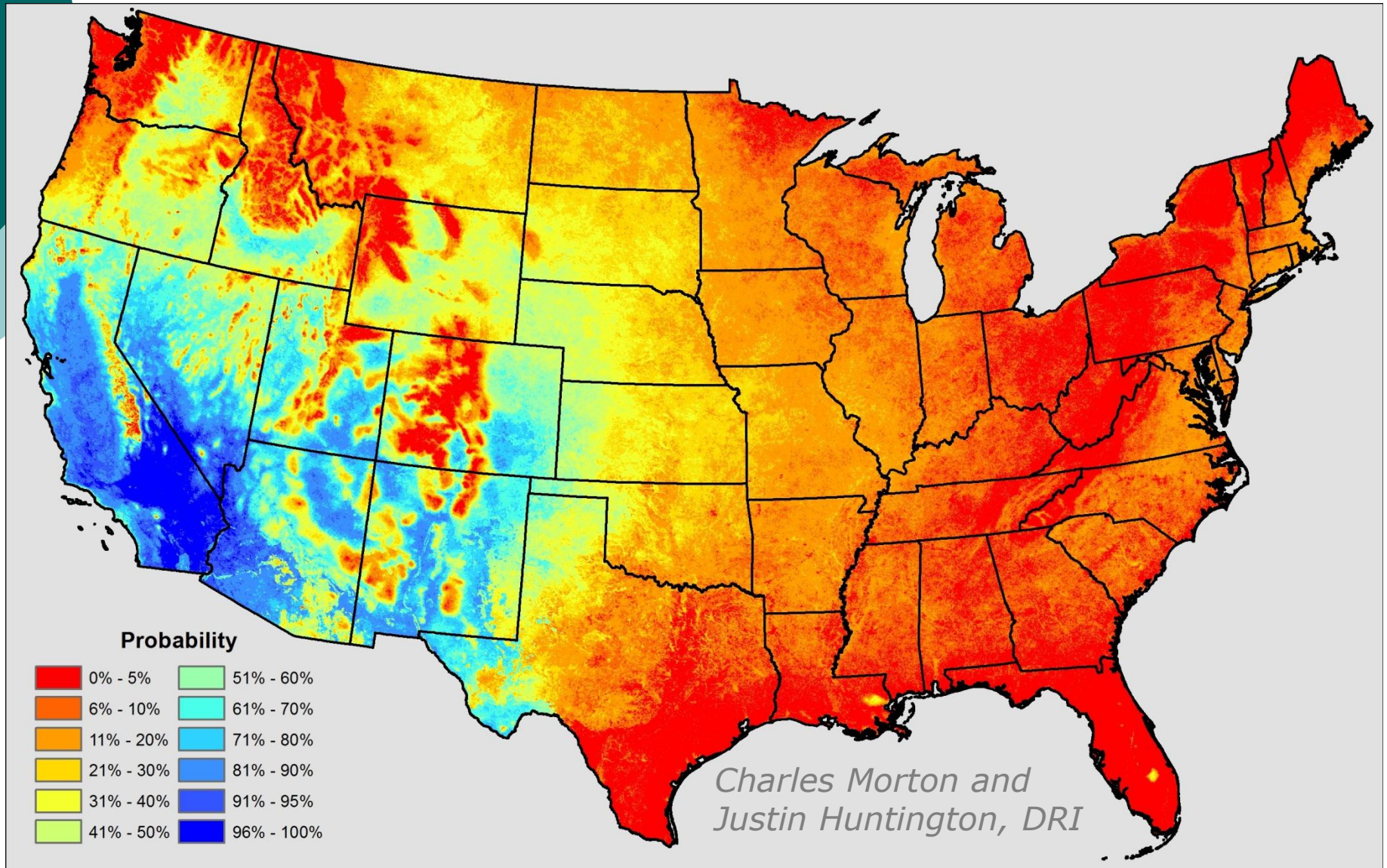
--analysis based on MODIS
Cloud Cover Assess. -- DRI

Probability of a Cloud-free Pixel at least every 32 days



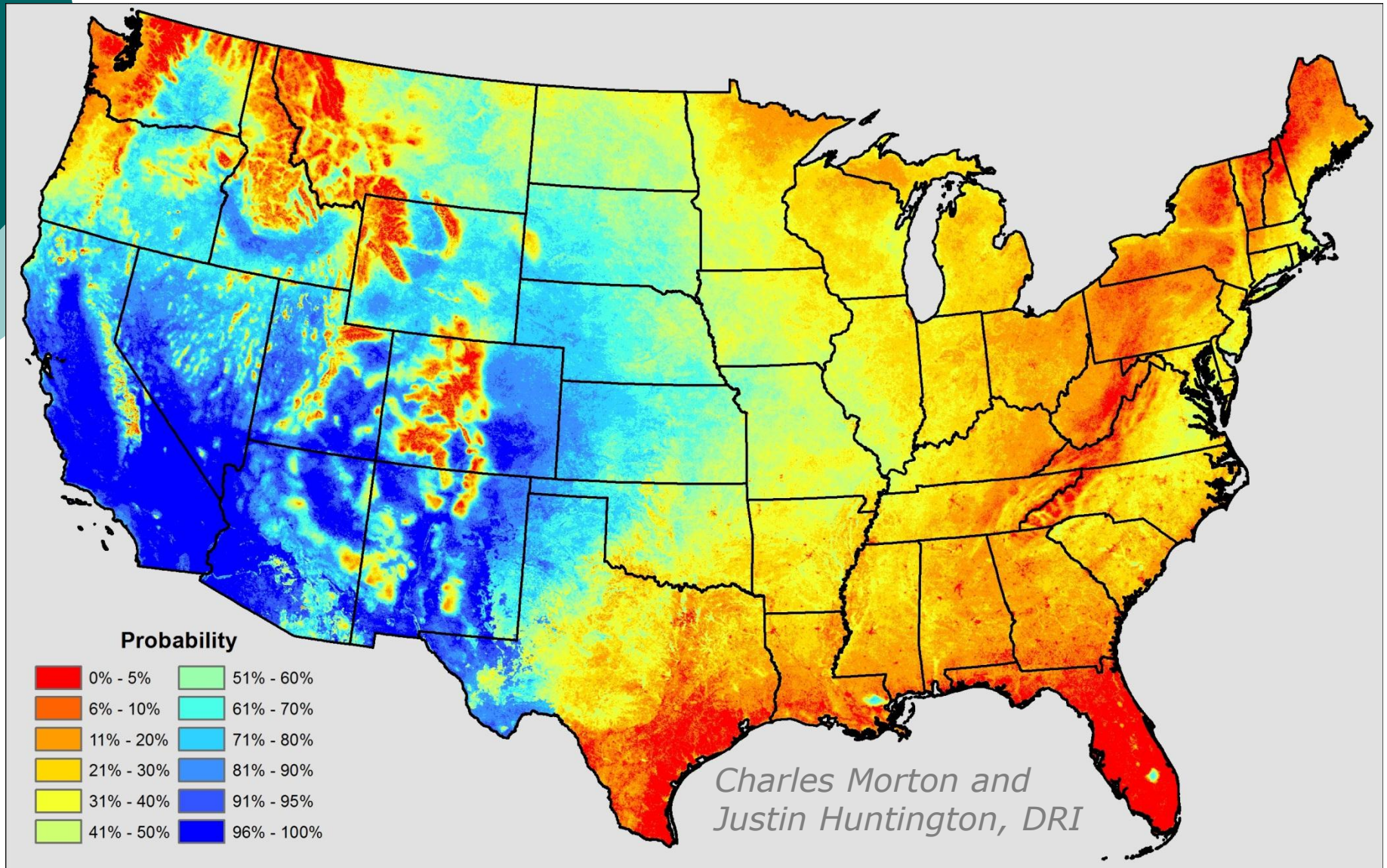
2 Satellites (image each 8 days)

Probability of a Cloud-free Pixel at least every 32 days



3 Satellites (image each ~5 days)

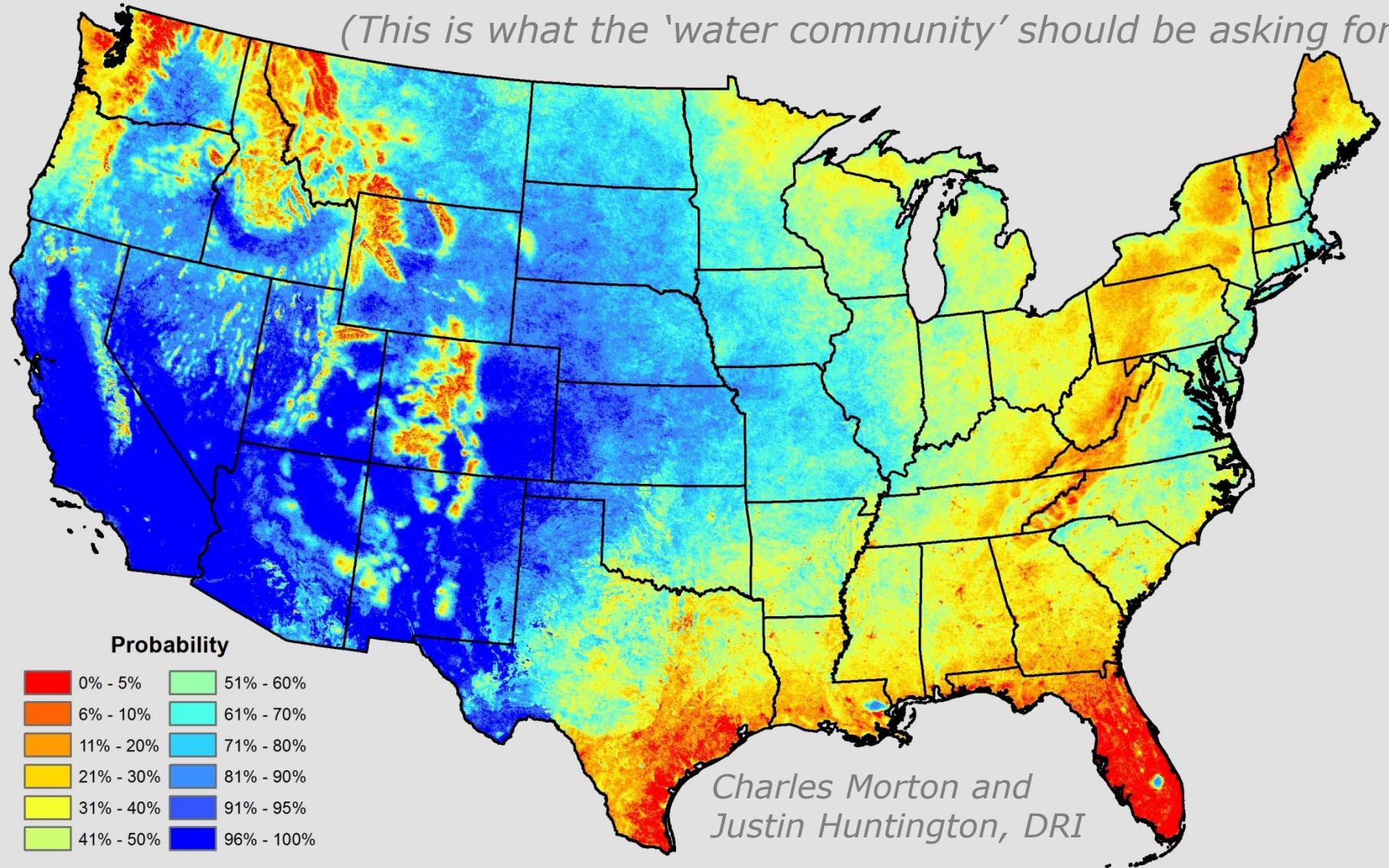
Probability of a Cloud-free Pixel at least every 32 days



4 Satellites (image each 4 days)

Probability of a Cloud-free Pixel at least every 32 days

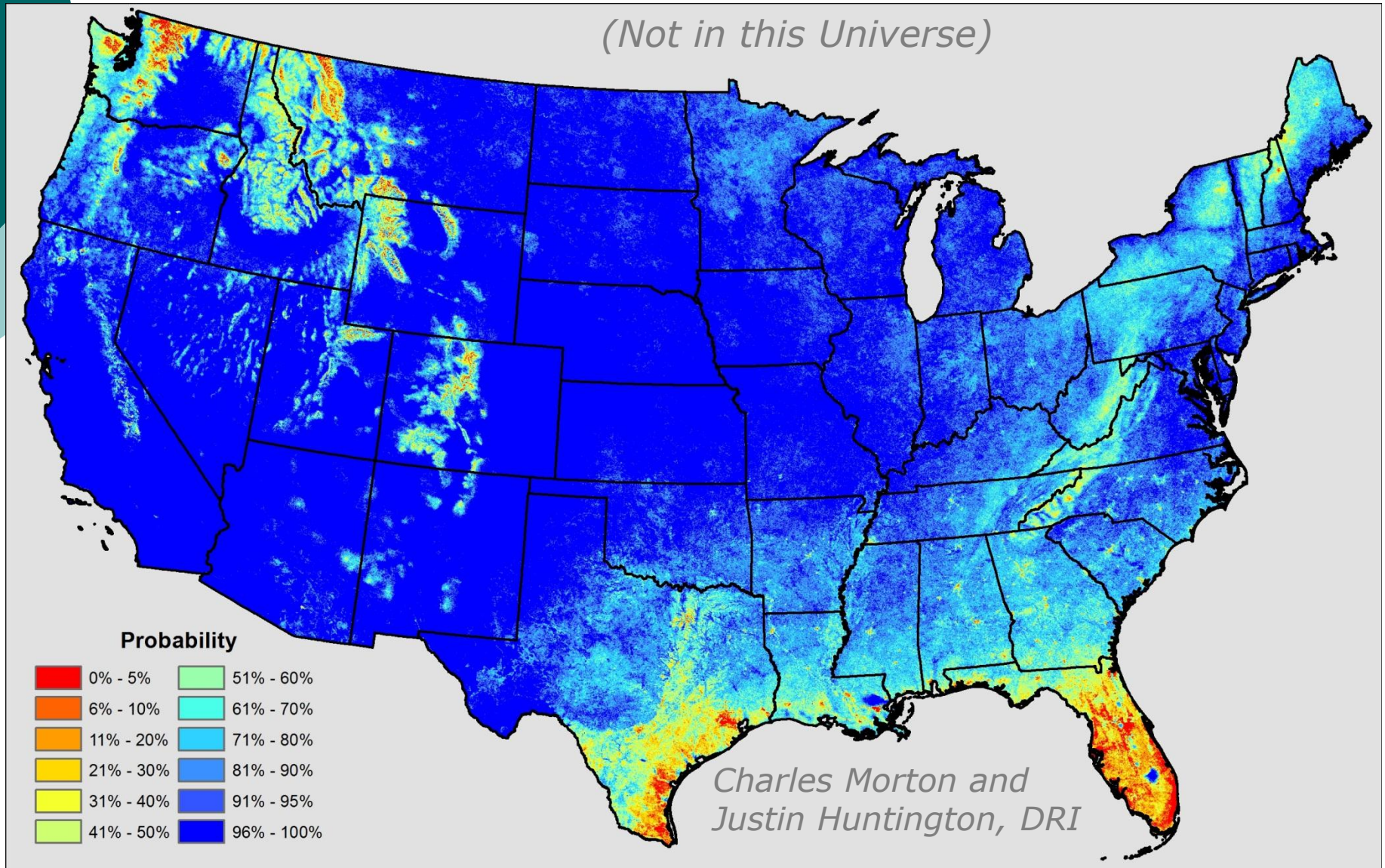
(This is what the 'water community' should be asking for)



8 Satellites (image each 2 days)

Probability of a Cloud-free Pixel at least every 32 days

(Not in this Universe)





Challenges

- Dealing with clouded periods
- Dealing with wetting events (irrigation/precipitation) between images
 - we will incorporate more data fusion w/MODIS, VIIRS and moderately high resolution reflectance data
- Getting more frequent return time